

WHAT IS CLAIMED IS:

1. A printing apparatus for printing an image on a print medium by using a print head, comprising:

5 a transport means for transporting the print medium by a driving force of a first drive source;

a feeding means for feeding the print medium to the transport means by a driving force of a second drive source; and

10 a recovery means for performing, by a first drive mechanism and a second drive mechanism, a recovery operation to maintain a printing performance of the print head;

wherein the first drive mechanism uses the first drive source as its drive source and is operated through a clutch mechanism according to a direction in which a driving force of the first drive source is generated, the clutch mechanism being adapted to transmit a rotation in only one direction of the first drive source;

20 wherein the second drive mechanism uses the second drive source as its drive source, has a dead zone in which a rotational force is not transmitted to the feeding means when the second drive source changes its rotation direction, and is operated in the dead zone according to a direction in which a driving force of the second drive source is generated.

2. A printing apparatus according to claim 1, wherein

the print head is an ink jet print head capable of ejecting ink from nozzles, and

one of the first drive mechanism and the second drive mechanism is a pump mechanism to produce a pressure for  
5 discharging ink not contributing to image printing from nozzles of the ink jet print head.

3. A printing apparatus according to claim 2, wherein the pump mechanism produces a negative pressure to suck  
10 out ink not contributing to image printing from nozzles of the ink jet print head.

4. A printing apparatus according to claim 2, further comprising:

15 a discharge means for discharging the print medium transported by the transport means;

wherein the transport means transports the print medium toward the discharge means by a driving force in one direction of the first drive source and transports the print medium  
20 from the discharge means toward the feeding means by a driving force in the other direction of the first drive source;

wherein the pump mechanism is the first drive mechanism and is not driven by a driving force in one direction of the first drive source and is driven by a driving force  
25 in the other direction of the first drive source.

5. A printing apparatus according to claim 2, wherein

the pump mechanism forms a piston pump having a piston adapted to move in a cylinder.

6. A printing apparatus according to claim 1, wherein  
5 the printhead is an ink jet printhead capable of ejecting ink from nozzles, and

one of the first drive mechanism and the second drive mechanism is at least a capping mechanism for capping the ink jet print head or a wiping mechanism for wiping a  
10 nozzle-formed face of the ink jet print head.

7. A printing apparatus according to claim 1, wherein the second drive mechanism is started when a driving force of the second drive source changes its direction from  
15 one direction to the other direction, and

the feeding means is not driven while the second drive mechanism is operating, feeds the print medium to the transport means by a driving force in one direction of the second drive source, and returns the print medium from the  
20 transport means by a driving force in the other direction of the second drive source.

8. A printing apparatus according to claim 7, wherein the feeding means has a dead zone in which it is not  
25 driven by a driving force of the second drive source from when the second drive mechanism starts until it completes the operation.

9. A printing apparatus according to claim 7, wherein,  
when the operation of the second drive mechanism is completed  
by a driving force in one direction of the second drive  
source, the second drive mechanism is not driven by a driving  
force in one direction subsequently produced by the second  
drive source.

10. A printing apparatus according to claim 9, further  
comprising:

a gear train for transmitting a driving force in one  
direction of the second drive source to the second drive  
mechanism; and

a notched portion provided at one part of the gear train,  
the notched portion being adapted to interrupt a  
transmission of the driving force in one direction of the  
second drive source to the second drive mechanism when the  
operation of the second drive mechanism using the driving  
force in one direction of the second drive source is  
completed.

11. A printing apparatus according to claim 1, wherein  
the feeding means has a dead zone in which it is not  
driven immediately by a driving force of the second drive  
source, and

the second drive mechanism is driven in the dead zone  
of the feeding means by driving forces in one direction

and the other direction of the second drive source.

12. A printing apparatus according to claim 1, wherein  
the second drive mechanism has its operation amount  
5 limited based on a result of detection by a position detection  
means that detects a position of a moving part of the second  
drive mechanism.

13. A recovery device for performing a recovery  
10 operation on a print head to maintain a printing performance  
of the print head, the print head being adapted to print  
an image on a print medium, the recovery device comprising:  
a first drive mechanism and a second drive mechanism  
for performing the recovery operation;

15 wherein the first drive mechanism uses as its drive  
source a first drive source for driving a transport means  
to transport the print medium and is operated through a  
clutch mechanism according to a direction in which a driving  
force of the first drive source is generated, the clutch  
20 mechanism being adapted to transmit a rotation in only one  
direction of the first drive source;

wherein the second drive mechanism uses as its drive  
source a second drive source for driving a feeding means  
to feed the print medium to the transport means, has a dead  
25 zone in which a rotational force is not transmitted to the  
feeding means when the second drive source changes its  
rotation direction, and is operated in the dead zone

according to a direction in which a driving force of the second drive source is generated.

14. A recovery method for performing a recovery  
5 operation on a print head to maintain a printing performance of the print head, the print head being adapted to print an image on a print medium, the recovery method comprising the steps of:

using a first drive mechanism and a second drive  
10 mechanism for performing the recovery operation;

wherein the first drive mechanism uses as its drive source a first drive source for driving a transport means to transport the print medium and is operated through a clutch mechanism according to a direction in which a driving  
15 force of the first drive source is generated, the clutch mechanism being adapted to transmit a rotation in only one direction of the first drive source;

wherein the second drive mechanism uses as its drive source a second drive source for driving a feeding means  
20 to feed the print medium to the transport means, has a dead zone in which a rotational force is not transmitted to the feeding means when the second drive source changes its rotation direction, and is operated in the dead zone according to a direction in which a driving force of the  
25 second drive source is generated.

15. A piston pump for reciprocally driving a piston

in a cylinder through a piston shaft by using a rotating force of a rotating body,

wherein the piston shaft is kept from rotating about its own axis,

5 wherein the rotating body is rotatable about the axis of the piston shaft,

wherein one of facing parts of a circumference of the piston shaft and a circumference of the rotating body is formed with a continuous spiral groove that crosses at one  
10 part,

wherein the other of the facing parts is provided with a projection that fits in the groove so that it is movable relative to the groove, in order to convert a rotary motion in at least one direction of the rotating body into a linear  
15 reciprocal motion of the piston shaft.

16. A piston pump according to claim 15, wherein a boat-shaped piece rotatable about an axis almost perpendicular to the axis of the piston shaft is mounted  
20 on the rotating body at a fixed position, and the projection is provided to the boat-shaped piece.

17. A piston pump according to claim 15, further comprising:

25 a rotary driving body; and

a clutch mechanism to transmit a rotating force in one direction of the rotary driving body to the rotating body.

18. A piston pump according to claim 17, wherein  
the clutch mechanism has a spring which is tightened  
by the rotation in one direction of the rotary driving body  
and transmits the rotating force and which is loosened by  
5 the rotation in the other direction of the rotary driving  
body and does not transmit the rotating force.

19. A piston pump according to claim 15, further  
10 comprising:  
a rotary driving body; and  
a transmission mechanism to transmit a rotating force  
of the rotary driving body to the rotating body;  
wherein the transmission mechanism has a dead zone in  
15 which the rotating force of the rotary driving body is not  
transmitted to the rotating body until the rotary driving  
body rotates a predetermined distance after it has changed  
its rotating direction.

20. A printing apparatus for printing an image on a  
print medium by using a print head, comprising:  
a recovery means for performing a recovery operation  
to maintain a function of the print head by using an  
introduced pressure;  
25 wherein the piston pump as claimed in claim 15 is used  
as a source of the pressure used by the recovery means.

21. A printing apparatus according to claim 20,  
wherein the print head is an ink jet print head capable  
of ejecting ink from its nozzles;

5 wherein the recovery means has a suction-based recovery  
function to suck out ink not contributing to image printing  
from the nozzles of the ink jet print head by using the  
introduced negative pressure;

wherein the piston pump generates the negative pressure  
used by the recovery means.

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22. A printing apparatus according to claim 20, further  
comprising:

a transport means for transporting the print medium  
by a rotating force of a transport roller;

15 wherein the piston pump is driven by the rotating force  
of the transport roller.

23. A printing apparatus according to claim 20,  
wherein the piston shaft of the piston pump is arranged  
20 on a rotary axis of the transport roller.

24. A printing apparatus according to claim 22,  
wherein the transport roller is a roller to transport  
the print medium from a printing operation position in a  
25 discharge direction.

25. A printing apparatus according to claim 20,

wherein the print head is an ink jet print head capable of ejecting ink from its nozzles by using thermal energy generated by electrothermal transducers.

5        26. A recovery device for performing a recovery operation to maintain a function of a print head by using an introduced pressure, the recovery device having the piston pump as claimed in claim 15 as a source of the pressure used by the recovery operation.

10        27. A recovery device according to claim 26,  
wherein the print head is an ink jet print head capable of ejecting ink from its nozzles;

15        wherein the recovery operation includes a suction-based recovery operation to suck out ink not contributing to image printing from the nozzles of the ink jet print head by using the introduced negative pressure;

wherein the piston pump generates a negative pressure used by the suction-based recovery operation.